Are birds scared by rotating mirrors?

Thomas W. Seamans, Scott C. Barras and Zachary J. Patton
USDA/Wildlife Services/National Wildlife Research Center
6100 Columbus Avenue
Sandusky, Ohio 44870-9660
Phone: 419-625-0242; Fax: 419-625-8465
Email: thomas.w.seamans@aphis.usda.gov

ABSTRACT: Blackbirds (Icteridae) create human health and safety concerns when roosting in large numbers near airports or other urban areas. Therefore, there is considerable demand for effective nonlethal techniques to deter these birds. We tested the effectiveness of rotating mirrors (Peaceful Pyramid®) to keep blackbirds away from decoy traps. Mirrors were in place on traps for 5 consecutive days with control traps having similar a device in place but without mirrors. The total number of birds captured in traps with clear mirrors and control traps did not ($P = 0.62$) differ. When red mirrors were used, the total number of birds captured was lower ($P = 0.01$) in treated than control traps. Similar ($P \geq 0.42$) numbers of brown-headed cowbirds (*Molothrus ater*) were caught in control or traps treated with either clear or red mirrors. Fewer ($P = 0.01$) common grackles (*Quiscalus quiscula*) were captured in traps with red mirrors as compared to control traps. Under the test criteria (i.e., food and flock attractants), Peaceful Pyramids®did not reduce the number of cowbirds captured in decoy traps. However, fewer birds, specifically common grackles, were captured at traps with red mirrors; we conclude that there was at least a species-specific initial reaction to red mirrors.

Key words: blackbirds, brown-headed cowbirds, common grackles, mirrors, *Molothrus ate*, *Quiscalus quiscula*

Blackbirds (Icterinae) and European starlings create human health and safety concerns when roosting in large numbers near airports or other urban areas (Cleary et al. 2002, Dolbeer et al. 2000, Barras et al. 2002). In February 1973, a Learjet 24 departing an airport in Georgia crashed and killed 8 people after striking a flock of brown-headed cowbirds. In February 1999, a Boeing-757-200 suffered extensive damage to the right wing and destruction of an engine when a flock of European starlings (*Sturnus vulgaris*) was encountered on takeoff (Cleary and Dolbeer 1999). In addition, blackbirds cause substantial economic loss to various agricultural crops (Heisterberg 1983, Hothem et al. 1988, Dolbeer 1990). Depredations by blackbirds on ripening field corn in the United States in 1981 was estimated at >272,000 metric tons worth $31 million (Besser and Brady 1986). Because large-scale killing of nuisance birds is often undesirable or impractical (Dolbeer 1986, 1998; Dornbush et al. 1996, Smith et al. 1999) there is considerable demand for effective nonlethal techniques to deter birds from crops and other problem sites.

Numerous harassment and frightening techniques are available to reduce conflicts involving birds (Solman 1994, Cleary 1994, Dolbeer et al. 1995). Many of these

techniques are expensive, ineffective, require multiple years to achieve desired results, produce short-lasting results, or have not been evaluated quantitatively. Mirrors have shown marginal effectiveness in altering bird behavior (Censky and Ficken 1982, Seamans et al. 2001). A recent addition to bird control equipment is the Peaceful Pyramid® (Bacton Wood Mill Farm, Edingthorpe, North Walsham, Norfolk, United Kingdom). This device contains 3 triangular mirrors (15 x 11.5 cm) positioned in a pyramid. In one arrangement, all mirrors are clear. In a variation, 2 mirrors are red and 1 is clear. The device, powered by a 12-v battery, rotates at approximately 30 revolutions/minute and deflects sunlight with the intention of confusing birds, thus making sites unattractive to birds.

Our objective was to conduct a field evaluation of the Peaceful Pyramid® bird scaring device at bird feeding areas. The goal was to provide airport managers with an objective recommendation concerning the efficacy of this control device. The National Wildlife Research Center Institutional Animal Care and Use Committee approved the procedures involving birds before the start of the study (QA-793).

METHODS

This study was conducted from 5 – 15 June 2001 and 30 April – 10 May 2002 at the National Aeronautics and Space Administration's Plum Brook Station (PBS), Erie County, Ohio. The 2,200-ha facility is enclosed by a 2.4-m high chain-link fence with barbed-wire outriggers. Habitat within PBS differed from surrounding agricultural and urban area and consisted of canopy-dogwood (*Cornus* spp., 39%), grasslands (31%), open woodlands (15%), and mixed hardwood forests (11%) (Rose and Harder 1985). Birds common to suburban and grassland areas in northern Ohio (e.g., brown-headed cowbird, American robin [*Turdus migratorius*], European starling, and red-tailed hawk [*Buteo jamaicensis*]) are commonly observed at PBS.

Six decoy traps (3.6 x 3.6 x 2.0 m; Dolbeer et al. 1995), > 1 km apart were set up with 3 – 5 banded female and 3 – 5 banded male brown-headed cowbirds placed in each trap. A bait tray containing white millet and sunflower seed was set below the trap opening. Water and feed were provided *ad libitum*. Three decoy traps were randomly selected to have a Peaceful Pyramid® with clear mirrors in 2001 and red/clear mirrors in 2002 set on the center of the decoy roof and activated for 5 consecutive days. The remaining 3 traps acted as controls by having a base with no mirrors attached placed in the center of the trap roof. After completion of 5 treatment days, all decoy traps were closed and the decoy birds removed for 2 days. Traps were then reactivated with new decoy birds and treatments switched such that control traps became treated and treated traps became controls. Traps were checked daily and the total number of birds captured in decoy traps was monitored, by species, throughout the test. All birds except the banded cowbirds were removed during the daily trap check.

Data gathered were not normally distributed. The number of birds captured in control and treated decoy traps were compared using the Mann-Whitney test (Statistix 1994). The alpha level used was 0.05.

RESULTS

CLEAR MIRRORS

In 2001, 7 species were captured in decoy traps during the test including American robin, brown-headed cowbird, common grackle (*Quiscalus quiscula*), European starling, house finch (*Carpodacus mexicanus*), mourning dove (*Zenaida macroura*), and red-winged blackbird (*Agelaius phoeniceus*) (Table 1). The number of cowbirds captured in control (45) and treated (30) traps did not differ ($Z = 0.237$; $P = 0.81$). The total number of birds captured in control (69) and treated (42) traps did not differ ($Z = 0.495$; $P = 0.62$). Common grackles and red-winged blackbirds accounted for 64 % of other birds captured. The number of grackles captured in control (13) and treated traps (1) did not differ statistically ($Z = 0.945$; $P = 0.34$). The number of red-winged blackbirds captured in control (2) and treated (7) traps did not differ ($Z = 0.893$; $P = 0.37$). Due to the small number of grackles and red-winged blackbirds captured the statistical comparisons for these species may not be meaningful.

RED/CLEAR MIRRORS

In 2002 8 species were captured in decoy traps during the test including brown-headed cowbird, common grackle, European starling, house finch, red-winged blackbird, blue jay (*Cyanocitta cristata*), and white-crowned sparrow (*Zonotrichia leucophrys*) (Table 2). Approximately 5 times more birds were captured in 2002 than in 2001. This increase may be attributed to conducting the 2002 work during spring migration versus the breeding season for 2001. The total number of birds captured in control (305) and treated (200) traps differed ($Z = 2.742$; $P = 0.01$). The number of cowbirds captured in control (233) and treated (167) traps did not differ ($Z = 1.474$; $P = 0.14$). Blue jays, common grackles, and red-winged blackbirds constituted 97 % of non-cowbirds captured. The number of blue jays captured in control (32) and treated (28) traps did not differ ($Z = 0.578$; $P = 0.56$). The number of common grackles captured in control (33) and treated (0) traps differed ($Z = 2.468$; $P = 0.01$). The number of red-winged blackbirds captured in control (6) and treated (3) traps did not differ ($Z = 1.050$; $P = 0.29$). Due to the small number of red-winged blackbirds captured, it is likely that the statistical comparison is not meaningful.

DISCUSSION

The primary sensory pathway in birds is vision (Sillman 1973). However, it is evident that there are species-specific vision characteristics (Sillman 1973, Blackwell 2002). Color and type of light used to frighten birds have shown species-specific reactions varying from indifference to flight (Belton 1976, Briot 1986, Blackwell et al. 2002, Gorenzel et al. 2002).

Mirrored devices are advertised as a painless means of disorienting birds when sunlight is reflected from the mirrors into the eyes of birds. The disorientation is claimed to cause birds to avoid protected areas. In both 2001 and 2002, tests were conducted during clear weather with only 1 and 3 overcast days respectively during 10 days of testing each year. Therefore, birds were exposed to reflected sunlight for almost the entire test. Due to the angle of the mirrors, once birds landed on the trap roof they likely were not exposed to reflected sunlight. However, to reach the roof, birds generally had to pass through a band of reflected sunlight and this did not appear to deter most species from the traps.

The use of mirrors alone and mirrors reflecting sunlight have failed to repel starlings, pigeons, or gulls (Belton 1976, Seamans et al. 2001) in other applications. In a blueberry field in Florida, fish crows (*Corvus ossifragus*) were observed feeding to within 6 m of an operating mirrored device with red mirrors 7 days after placement (E. Tillman, U.S. Department of Agriculture/National Wildlife Research Center/Florida Field Station, unpublished data). The target species in this study was brown-headed cowbirds. Neither cowbirds nor starlings were repelled from a perch when exposed to long-wavelength (red) lasers (Blackwell et al. 2002); therefore, the lack of measurable response in this experiment both with clear and red mirrors may have been anticipated. However, the apparent response of common grackles to red mirrors, but possibly not to clear mirrors requires further investigation to determine if there is a real difference.

In non-replicated uses of these devices with both red and clear mirrors, red-winged blackbirds did not appear to be deterred from feeding in sweet corn fields in northern Ohio. In a second use, approximately 300 ring-billed gulls (*Larus delawarensis*) were not deterred from roosting on an industrial roof in northwestern Ohio by red or clear rotating mirrors. Although the gulls stayed about 5 m from the devices, they continued to use the roof.

Under the test criteria used in northern Ohio (i.e., food and flock attractants), Peaceful Pyramids® with clear mirrors did not reduce the number of blackbirds or birds in general captured in decoy traps. However, when red mirrors were used, fewer total birds were captured. Therefore, the basic trend over 2, 5-day periods indicates that there was at least an initial reaction of some species of birds to rotating red mirrors. It is possible that under longer testing periods birds may habituate to these devices as they have in other reported tests of scare devices (Will 1985, Littauer 1990). However, we have no data to suggest they do.

Responses of birds to scare devices vary under different conditions and among species (Belant et al. 1996, Blackwell et al. 2002). Therefore, there may be species or situations in which clear mirrored devices may have an effect on birds. Based on the current results, further tests with clear and red mirrors should be conducted. As with any scare device, an integrated approach using multiple scare devices and habitat modifications provides the most likely method of successfully scaring birds away from desired areas.

ACKNOWLEDGMENTS

We thank R. M. Puzak, National Aeronautics and Space Administration, Plum Brook Station for providing access to the study site. G. E. Bernhardt, J. D. Cepek, and R. J. White provided field assistance. Sponsorship and funds for this research were provided by the Federal Aviation Administration (FAA). Opinions expressed in this study do not necessarily reflect current FAA policy decisions governing the control of wildlife on or near airports.

REFERENCES

Barras, S. C., S. E. Wright, and T. W. Seamans. 2002. Blackbird and starling strikes to civil aircraft, 1990 – 2001. Proceedings of the symposium on Management of North American Blackbirds, Bismark, ND, USA.

Belant, J. L., T. W. Seamans, and C. P. Dwyer. 1996. Evaluation of propane exploders as white-tailed deer deterrents. Crop Protection 15:575 – 578.

Belton, P. 1976. Effects of interrupted light on birds. National Research Council Canada. Field Note No. 73.

Besser, J. F., and D. J. Brady. 1986. Bird damage to ripening field corn increases in the United States from 1971 to 1981. U.S. Fish and Wildlife Service Leaflet 7.

Blackwell, B. F. 2002. Understanding avian vision: the key to using light in bird management. Proceedings of the Vertebrate Pest Conference 20: IN PRESS.

Blackwell, B. F., G. E. Bernhardt, and R. A. Dolbeer. 2002. Lasers as nonlethal avian repellents. Journal of Wildlife Management 66:250—258.

Briot, J. L. 1986. Last French experiments concerning bird-strike hazards reduction (1981 – 1986). Bird Strike Committee Europe 18/working paper, Copenhagen, Denmark.

Censky, E. J., and M. S. Ficken. 1982. Responses of black-capped chickadees to mirrors. The Wilson Bulletin 94:590 – 593.

Cleary, E. C. 1994. Waterfowl. Pages E139-E155 *in* S. E. Hyngstrom, R. M. Timm, and G. E. Larson, editors. Prevention and control of wildlife damage. University of Nebraska Cooperative Extension Service, Lincoln, Nebraska.

Cleary, E. C., and R. A. Dolbeer. 1999. Wildlife hazard management at airports. Federal Aviation Administration, Office of Airport Safety and Standards, Airport Safety and Compliance Branch, Washington, D. C.

Cleary, E. C., S. E. Wright, and R. A. Dolbeer. 2002. Wildlife strikes to civilian aircraft in the United States, 1990-2000. Federal Aviation Administration, Wildlife Aircraft Strike Database Serial Report Number 7.

Dolbeer, R. A. 1986. Current status and potential of lethal means of reducing bird damage in agriculture. International Ornithological Congress 19:474-483.

Dolbeer, R. A. 1990. Ornithology and integrated pest management: red-winged blackbirds *Agelaius phoeniceus* and corn. Ibis 132:309-322.

Dolbeer, R. A. 1998. Population dynamics: the foundation of wildlife damage management for the 21st Century. Proceedings of the Vertebrate Pest Conference 18:2-11.

Dolbeer, R. A., N. R. Holler, and D. W. Hawthorne. 1995. Identification and control of wildlife damage. Pages 474-506 *in* T. A. Bookhout, ed. Research and management techniques for wildlife and habitats. The Wildlife Society, Bethesda, MD.

Dolbeer, R. A., S. E. Wright, and E. C. Cleary. 2000. Ranking the hazard level of wildlife species to aviation. Wildlife Society Bulletin 28:372–378.

Dornbush, C., G. Feigelson, D. Gruskin, B. Hedges, and A. Turner. 1996. Non-lethal controls for "resident" Canada geese. A report presented by the executive committee of the Canada Geese Citizens Advisory Committee, Rockland County, New York.

Gorenzel, W. P., B. F. Blackwell, G. D. Simmons, T. P. Salmon, and R. A. Dolbeer. 2002. Evaluation of lasers to disperse American crows, *Corvus brachyrhynchos*, from urban night roosts. International Journal of Pest Management 48:327–331.

Heisterberg, J. F. 1983. Bird damage to sprouting corn in Kentucky and Tennessee. Proceedings Annual Conference Southeastern Association of Fish and Wildlife Agencies. 37:41-48.

Hothem, R. L., R. W. DeHaven, and S. D. Fairaizl. 1988. Bird damage to sunflower in North Dakota, South Dakota, and Minnesota, 1979-1981. U. S. Department of Interior, Fish and Wildlife Technical Report 15.

Littauer, G. 1990. Avian predators. Frightening techniques for reducing bird damage at aquaculture facilities. Southern Regional Aquaculture Center Publication 401. 4 p.

Rose, J., and J. D. Harder. 1985. Seasonal feeding habits of an enclosed high density white-tailed deer herd in northern Ohio. Ohio Journal of Science 85:184–190.

Seamans, T. W., C. D. Lovell, R. A. Dolbeer, and J. D. Cepek. 2001. Evaluation of mirrors to deter nesting starlings. Wildlife Society Bulletin 29:1061 - 1066.

Sillman, A. J. 1973. Avian vision. Pages 349-387 *in* D. S. Farner, J. R. King, and K. C. Parkes, editors. Avian Biology Volume III. Academic Press, New York, New York, USA.

Smith, A. E., S. R. Craven, and P. D. Curtis. 1999. Managing Canada geese in urban environments. Jack Berryman Institution Publication 16, and Cornell University Cooperative Extension, Ithaca, New York.

Solman, V. E. F. 1994. Gulls. Pages E49-52 *in* S. E. Hyngstrom, R. M. Timm, and G. E. Larson, editors. Prevention and Control of Wildlife Damage. University of Nebraska Cooperative Extension Service, Lincoln.

Statistix. 1994. User's manual, version 4.1. Analytical Software, Tallahassee, Florida. 329 pages.

Will, T. J. 1985. Air Force problems with birds in hangars. Proceedings Eastern Wildlife Damage Control Conference 2:104 – 114.

Table 1. Species, numbers and 95 % confidence intervals of birds captured in 6 decoy traps, each containing 6 brown-headed cowbirds as decoys, operated for 10 days (5 – 15 June) either with or without a mirrored device in Erie County, Ohio, 2001.

	Control			Treated		
Species	Total	Mean	95% CI	Total	Mean	95% CI
American robin	1	0.1	0 - 0.42	0	0	0
Brown-headed cowbird	48	6.0	0.3 - 12	35	4.4	2.2 - 6.6
Blue jay	0	0	0 - 0	0	0	0
Common grackle	13	1.6	0 - 4.2	1	0.1	0 - 0.4
European starling	3	0.4	0 - 0.8	1	0.1	0 - 0.4
House finch	5	0.6	0 - 2.1	0	0	0
Mourning dove	0	0	0 - 0	3	0.4	0 - 1.3
Red-winged blackbird	2	0.3	0 - 0.6	7	0.9	0 - 2
White-crowned sparrow	0	0	0 - 0	0	0	0

Table 2. Species, numbers and 95 % confidence intervals of birds captured in 6 decoy traps, each containing 10 brown-headed cowbirds as decoys, operated for 10 days (30 April – 10 May) either with or without a mirrored device in Erie County, Ohio, 2002.

	Control			Treated		
Species	Total	Mean	95% CI	Total	Mean	95% CI
American robin	0	0	0	0	0	0
Brown-headed cowbird	233	29.1	15.0 - 43.2	167	20.9	10.3 - 31.5
Blue jay	32	4	1.0 - 7.0	28	3.5	0 - 7.9
Common grackle	33	4.1	0.5 - 7.8	0	0	0
European starling	0	0	0	1	0.1	0 - 0.4
House finch	0	0	0	1	0.1	0 - 0.4
Mourning dove	0	0	0	0	0	0
Red-winged blackbird	6	0.8	0.2 - 1.3	3	0.4	0 - 1.0
White-crowned sparrow	1	0.1	0 - 0.4	0	0	0